CLAIMS

What is claimed is:

1. A manufacturing method of an optical communication module that optically couples an optical device and an optical transmitter, comprising:

providing a tapered through-hole in a substrate;

housing an optical device, whose optical transmission point substantially coincides with a geometrical center in the tapered through-hole; and

inserting an optical transmitter having a larger diameter than a diameter of the optical device in the tapered through-hole housing the optical device.

2. The manufacturing method of the optical communication module according to claim 1, further comprising:

housing an optical device, whose diameter is larger than the diameter of the optical device and smaller than the diameter of the optical transmitter in the tapered through-hole, after housing the optical device.

3. A manufacturing method of an optical communication module that optically couples an optical device and an optical transmitter, comprising:

providing a double-ended tapered through-hole having a constriction portion inside of a substrate and openings on both sides of the substrate so as to be opened bi-directionally;

housing an optical device, from one opening in the double-ended tapered through-hole, whose optical transmission point substantially coincides

with a geometrical center, and which has a smaller diameter than a diameter of one opening of the double-ended tapered through-hole; and

housing an optical transmitter, from the other opening in the double-ended tapered through-hole, whose diameter is smaller than a diameter of the other opening of the double-ended tapered through-hole.

4. The manufacturing method of the optical communication module according to claim 3, comprising:

housing an optical device, from the other opening of the double-ended tapered through-hole, whose diameter is smaller than the diameter of the optical transmitter, before housing the optical transmitter.

5. The manufacturing method of the optical communication module according to claim 1, further comprising:

forming an electrode wiring for conduction with an electrode provided in a part of the optical device before housing the optical device.

6. The manufacturing method of the optical communication module according to claim 1, further comprising:

forming an electrode wiring for conduction with an electrode provided in the optical device after housing the optical device.

7. The manufacturing method of the optical communication module according to claim 1, wherein the step of forming the through-hole comprises:

irradiating the substrate with and while relatively moving a femto-second pulse laser in an axial direction of the through-hole; and

removing a region of the substrate changed by the irradiation of the femto-second pulse laser so that the through-hole emerges.

8. The manufacturing method of the optical communication module according to claim 1, comprising:

fixing at least one of a periphery of the housed optical device and a periphery of the housed optical transmitter with resin after housing the at least one of the optical device and the optical transmitter.

9. The manufacturing method of the optical communication module according to claim 1, wherein, in the step of housing the optical device, the optical device includes a side surface contacting an internal wall of the through-hole at an inclination corresponding to a tapered shape of the internal wall of the through-hole at a contacting position.

10. The manufacturing method of the optical communication module according to claim 9,

wherein the optical device contacts the internal wall of the through-hole in a vicinity of a bottom surface of the substrate when housed in the through-hole.

11. An electronic apparatus comprising the optical communication module manufactured by the manufacturing method of the optical communication module according to claim 1.

12. An optical communication module that optically couples an optical device and an optical transmitter, comprising:

a substrate provided with a tapered through-hole having a first opening with a larger diameter than a diameter of an optical device to be housed and a diameter of an end surface of an optical transmitter to be housed, and a second opening with a smaller diameter than the diameter of the optical device and the diameter of the end surface of the optical transmitter; and

an electrode wiring for the optical device that is formed from one of the first opening and the second opening along an internal wall of the tapered through-hole.

13. An optical communication module that optically couples an optical device and an optical transmitter, comprising:

a substrate provided with a double-ended tapered through-hole having a constriction portion with a smaller diameter than a diameter of the optical device to be housed and a diameter of an end surface of the optical transmitter

to be housed and having openings on both sides of the substrate so as to be opened bi-directionally; and

an electrode wiring for the optical device that is formed, at least, from one of the openings along an internal wall of the double-ended tapered through-hole.